

UNIVERSITY OF CALIFORNIA PUBLICATIONS

COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
BERKELEY, CALIFORNIA

OBSERVATIONS ON SOME RICE WEEDS IN CALIFORNIA

By P. B. KENNEDY



Awned and awnless forms of water grass, *Echinochloa crus-galli*.

BULLETIN No. 356

APRIL, 1923

UNIVERSITY OF CALIFORNIA PRESS
BERKELEY, CALIFORNIA

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OBSERVATIONS ON SOME RICE WEEDS IN CALIFORNIA

BY P. B. KENNEDY

DESCRIPTION OF WEEDS

WATER GRASS, *Echinochloa crus-galli*, and varieties. (See frontispiece and figs. 1 to 3.)—This grass with its varieties is the most abundant and widely distributed weed in the rice growing districts of the state. Since it is able to grow either in the flooded fields and waterways or on the levees, it has spread over large areas of the country where rice is grown.

At threshing time a considerable quantity of water grass seed gets into the sacks with the rice. There are without doubt several different field varieties of the grass in the rice fields, namely (*a*) an early form, which is short, and matures and drops its seed early, before the rice is headed out; (*b*) a mid-summer form, which heads out about the same time as the rice, but drops most of its seed before the rice is harvested; and (*c*) a late form, which is in full seed at the time the rice is harvested. A satisfactory classification of these varieties has not yet been made.

The water grass is an annual and a prolific seeder. Chamliiss and E. Adams have estimated that a single plant may produce as many as 40,000 seeds. Little is known regarding the varying conditions to which water grass seed may be subjected and still remain viable. It remains to be determined how long it will retain its viability if it is plowed under either in dry or in wet soil. Again is it similar to wild oats and mustard, which will lie dormant for a long period in the soil and grow again when they are brought up to the surface? Does it require a period of rest, or will it germinate directly when it is taken from the plants? What is the optimum condition of temperature and moisture for its germination? These and many similar questions regarding water grass seed remain unanswered. Take the case of a stubble field that had been planted in rice the previous year. It was seen in summer, when it was being flooded preparatory to plowing. Millions of seedlings of water grass plants covered large areas of the flooded portion. In unflooded areas no seedlings were visible, yet the seeds there must have received the natural rainfall. Presumably it came too early in the season to cause their germination. Evidently the temperatures of late fall, winter, and early spring, the times when we receive most of our natural

precipitation, are too low for the successful germination of water grass seed. This suggests that flooding in summer to germinate the



a



b

Fig. 1.—Forms of Water-grass, *Echinochloa crus-galli*. *a*. Awnless form.
b. Awned form.

seeds, and then plowing under the young seedlings is one of the most effective methods of cleaning foul rice lands. Repeating the flooding and then disking should also be very effective.

Controlling water grass by the submergence method is gaining many adherents. The results of the experiments of the State Rice Experiment Station at Cortena seem to corroborate the earlier trials



Fig. 2.—Seeds of Water-grass, with and without seed coats and awns.

made by some of the rice growers which showed that water grass will not come up through eight inches of water, while the rice will. It is evident that the water grass plant needs access to the air soon after germination. More experiments are needed to determine how deep the water must be in order to suppress it successfully.

Controlling water grass by rotating the rice crop with some other crop, especially a legume, would be an ideal method but as yet we have not the drainage or soil conditions required in order to grow



Fig. 3.—Typical Water-grass on levees of rice field.

any other crop successfully. On some of the better lands, not typical rice lands, grain or sorghum will produce good crops in a rotation. Rotation trials with a large number of crops need to be carried on in the near future.

Hand weeding is effective, but expensive. It is not generally practiced except where the rice crop is being grown for seed. The common practice is to use the curved Japanese weed knife and cut off the roots well below the crown. The plants must be removed from the field or they will root and grow again. This necessitates much labor, since one must carry the bundles to the levees or use a small boat to carry the cut weeds. A boat necessitates frequent trips through the rice to unload, causing much damage.



Fig. 4.—Joint Grass, *Paspalum distichum*.

It is hardly necessary to mention the use of clean seed rice as an effective method of control. Growers should examine the fields of persons growing rice for seed, and place their orders with those having the cleanest fields.

JOINT GRASS, *Paspalum distichum*. (See fig. 4.)—This perennial creeping grass spreads very rapidly by the process of rooting at each joint or node. It will grow even if submerged, the stems extending to the surface. If subjected to drought, it will continue to live through the season until moisture is supplied by the rains.

Joint grass is becoming more abundant each year in the rice fields. In the alkali regions of the San Joaquin Valley the seeds and leaves form a large proportion of the food of wild ducks. It is one of the best grasses for cattle in swampy areas. Though it is not yet a serious menace, the problem of eradicating it will be a difficult one. Successive plowing and cultivating during the summer will be necessary factors in the process.

SPRANGLE TOP, *Leptochloa fascicularis*. (See fig. 5.)—Sprangle top is erroneously called “ray” grass in the rice sections. The name Spreading Millet has also been applied to it in parts of the San Joaquin Valley. Scale Grass was the name given by the author in “Weeds of California.” It is an annual grass, usually associated with stagnant water and alkaline soils so that we find it more commonly



Fig. 5.—Dense growth of Sprangle-top, *Leptochloa fascicularis*, among rice.

along seepage places by the roadside and in drainage ditches than in the rice fields. The stems are erect-spreading, terminating in a succession of erect slender spikes three to five inches long, branching from the main axis and bearing the spikelets. The spikelets are seven- to eleven-flowered, with a short awn from each floret. Although more or less abundant in the rice sections we have not as yet observed any localities where it has seriously interfered with the rice crop.

CANARY GRASSES, *Phalaris*. (See figs. 6, 7, 8, 9.)—The term California Timothy is frequently given to these grasses. They are annual wayside weeds throughout the state. Some of them occupy the land almost exclusively during the first year of fallow after the rice crop. The most abundant species in the rice are *P. brachystachys*, *P. paradoxa*, and *P. minor*.



Fig. 6.—Heads of Gnawed Canary Grass, *Phalaris paradoxa*.

They grow both on dry and wet lands, and illustrate how much trouble can be caused to the rice crop by a dry land plant. They make an early and rapid growth during the spring and sometimes cause serious damage to the young rice crop before flooding is commenced. The flower is in the form of a head which closely resembles that of timothy. It later develops small shiny yellowish-brown seeds.

RICE CUT GRASS, *Leersia oryzoides*. (See fig. 10.)—The rice cut grass is a close relative of the cultivated rice and should be regarded with suspicion. It is an introduced perennial grass, and although it is not abundant at the present time, there seems no reason to believe that it will not find conditions among the rice exactly to its liking. We found it in dense tangled masses in the sloughs near Biggs im-



Fig. 7.—Seed of Gnawed Canary Grass, *Phalaris paradoxa*.

peding the flow of the water by forming small islands which held back the silt. Occasionally it was also seen along the roadsides in moist places bordering on the cat-tails. The seed resembles rice in general shape, but is smaller and remains flat without producing a prominent grain. It has creeping rootstocks.

CRAB GRASS, *Syntherisma sanguinalis*.—This is an annual weedy grass introduced from Europe, and commonly occurring along roadsides, in waste moist places and on levees. A single plant may cover a considerable area of ground through having many stems rooting at the nodes. The flowers are disposed on branches similar to the fingers on a hand, so that it is sometimes called finger grass. It is

not unlike Bermuda grass, except that the fingers are very much longer. Its rooting system is not as persistent as that of Bermuda grass, which differs from it also in being a strong perennial.

TUFTED LOVE GRASS, *Eragrostis pilosa*.—This is a slender feathery-like annual weedy grass occurring abundantly in the laterals in the



Fig. 8.—Bracted Canary Grass, *Phalaris brachystachys*.

rice growing sections where it impedes the flow of water. So far as we have observed, it has not yet proved troublesome to the rice crop.

BEARD GRASS, *Polypogon monspeliensis*. (See fig. 11.)—Beard grass is an annual weedy grass, common in moist waste places and along irrigation and drainage ditches throughout the state. It withstands very wet conditions, especially in heavy lands. On overflowed areas, where the water becomes stagnant for the want of an outlet or from under-drainage, it is especially aggressive and becomes a serious pest.

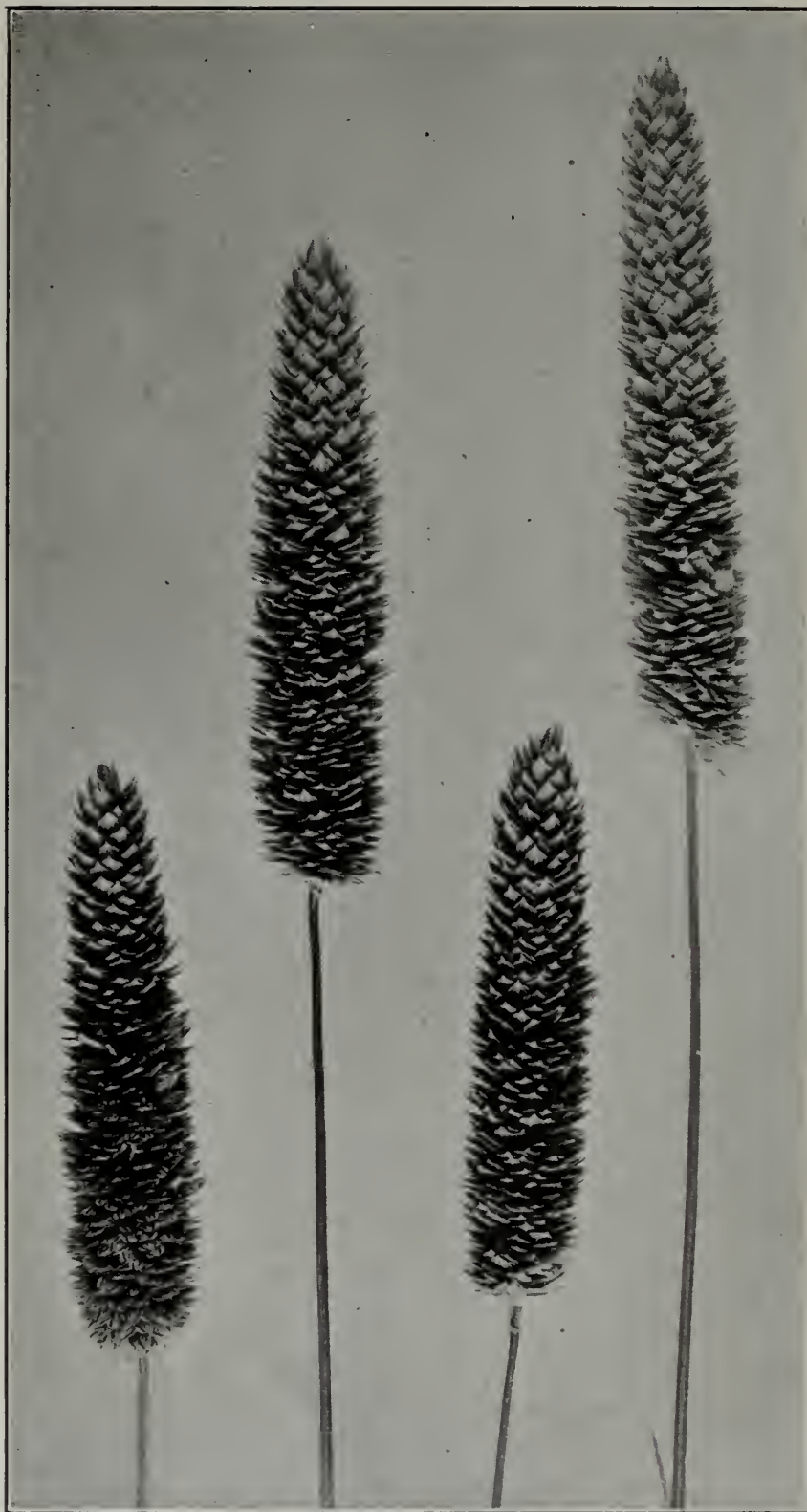


Fig. 9.—Heads of Small Canary Grass (California Timothy), *Phalaris minor*.

The flowers are borne on a loose head or spike from one to six inches long and from one-half an inch to an inch or more in diameter. The spike is tawny or tinged with purple when young, becoming



Fig. 10.—Rice Cut-grass, *Leersia oryzoides*.



Fig. 11.—Beard Grass, *Polypogon monspeliensis*, on ditch bank.

yellow with age. The seeds possess yellowish bristles from which the name beard grass is derived. Sheep men who graze their sheep in the rice districts complain that the tiny sharp seeds injure the eyes of lambs while they are feeding. A similar species is Alkali Beard Grass, *P. littoralis*.

RED RICE, *Oryza rufipogon*.—This is one of the worst pests in the rice industry throughout the world. It is slowly but surely establishing itself in the rice districts of California. In the southern states it is considered the most widely distributed and the most difficult to contend with of all rice pests.

Red rice is as good a food as white rice. In fact the Hindus prefer to eat red rice. Our market, however, demands white rice. The objection to red rice comes from the millers, who are obliged



Fig. 12.—Wild Millet or Pigeon Grass, *Setaria viridis*.

to grind off the red coat to make it acceptable to the public. In doing this they must mill off the white rice to a degree that entails much waste before the red coating of the red rice is removed. Six years ago it was exceedingly difficult to find any red rice in California, but today it is found in many localities. The red rice situation in California at the present time may be met by first locating the infestations and weeding them out by hand, and then sowing only such rice seed as is free from the red variety.

Red rice plants are usually more vigorous and aggressive than those of white rice. The stems have a tendency to stool at an angle and are not erect like those of white rice. Where red rice is abundant the fields take on a darker green. This rice matures early and the grain shatters readily, so that much of it has already fallen to the ground before harvest time. It is said to remain in the ground even when thorough summer fallowing is practiced.

SLOUGH GRASS, *Beckmannia erucaeformis*.—Slough grass is a rather tall erect perennial grass with flat leaves and imbricated spikelets resembling the rattles of a rattle-snake. It is found on swampy lands, in irrigation ditches, and along streams. It tolerates alkali to a considerable degree. It is of value as forage, especially when young.



Fig. 13.—Heads of Italian Rye Grass, *Lolium multiflorum*.

PIGEON GRASS; WILD MILLET, *Setaria*. (See fig. 12.)—An annual grass introduced from Europe and now abundant in the United States. It occurs in gardens, alfalfa fields, and cultivated areas generally throughout California. The plant grows to a height of about two feet, the stems terminating in a head or spike resembling timothy, but with five or more tawny yellow bristles about a quarter of an inch

long surrounding each flower in the head. This grass and a closely related species, Green Wild Millet, *S. viridis*, found in similar situations in the state, are the progenitors of our well-known cultivated foxtail millet or Hungarian grass. Although frequent in the rice districts, it does not prove troublesome in connection with the rice crop.



Fig. 14.—A typical Umbrella Plant, *Cyperus virens*.

ITALIAN RYE GRASS, *Lolium multiflorum*. (See fig. 13.)—This plant is a tufted short-lived perennial grass when growing in heavy soil on the coast, and an annual on sandy land without irrigation. It grows from one to three feet high, with slender flat spikes from six to twelve inches long on the end of the stems. It is found throughout the state wherever there is fertile pasture land well supplied with moisture. This accounts for its presence in certain localities in the rice districts. Rye grass is relished by stock, and it could hardly be classed as a weed except that it occurs along roadsides and in fields and waste places.

SALT GRASS, *Distichlis spicata*.—This is a common grass in salt marshes and alkaline soils along the coast and the interior deserts and valleys of California. It forms a sod by means of rootstocks, and is most common where the water table comes close to the surface. It thrives even in ground heavily crusted with alkali. It sometimes encroaches upon cultivated land, where it becomes a pest owing to its tough matted roots. Although it is sometimes fenced and used for pasturage, it must be considered chiefly as an emergency forage plant. It will keep stock alive, but they seldom do well on it.



Fig. 15.—Small-flowered Umbrella Plant, *Cyperus difformis* (?) in alleys between trial plots of rice at Federal Rice Station, Biggs, Calif.

Salt grass is difficult to eradicate. Shallow plowing, say about four inches deep, so as to keep the roots near the surface, is better than deep plowing, which causes the roots to take a firmer hold on the ground. It would take a whole year of constant cultivation without a crop to subdue this pest. Exposing the roots to the hot drought of summer is the method of eradication most to be relied upon.

UMBRELLA PLANTS, *Cyperus*. (See figs. 14 and 15.)—Several species of these water-loving plants are on the increase in the rice districts and are extending from the ditch banks and laterals into the rice fields. They are annuals with triangular stems, on the ends of which are borne flowers arranged very much like the ribs of an umbrella that has been inverted by the wind. They produce an abundance of tiny seeds. The small-flowered umbrella plant, *C. difformis* (?) grows along with the rice. Unless it becomes too abun-

dant it does not seem to interfere seriously with the yield. This weed seems to be an introduction from Japan. It does not grow higher than the rice. *C. virens*, *C. erythrorhizos* are taller species which confine themselves mostly to the ditches and levees. Two perennial species with nutlets on their roots, *C. esculentus* and *C. rotundus*, are serious pests in the delta lands and elsewhere in the state. They are known as "nut grasses" and have proven extremely difficult to eradicate.



Fig. 16.—Spike Rush (Wire-grass), *Eleocharis palustris*.

COMMON BULRUSH or TULE, *Scirpus occidentalis*.—This is a well known perennial plant with round stems, covering thousands of acres in our great interior valley. Its dark green leafless stems grow from three to ten or more feet high, forming dense thickets in swampy lands. Clusters of brownish flowers appear near the end of the stem. Another species similar to the first in all respects except for a small difference in the flowers is *S. californicus*. The tule does not seem to tolerate cultivation, as it is not troublesome in well prepared rice fields, preferring the ditches and undisturbed areas.

THREE SQUARE BULRUSH, *Scirpus robustus*.—A triangular stemmed perennial plant with long leaves equaling or exceeding the stems. It frequents moist alkaline soils. The flowers are in clusters of rather large spike-like brownish heads. It resembles some of the Umbrella plants (*Cyperus*), which also have triangular stems, but it can be distinguished from them by its seeds which are brown, shiny, lense-shaped, and much larger, being about one eighth of an inch

long. A similar species with the same habitat is Olney's bulrush, *S. olneyi*, which is practically leafless. Although they are water plants, the triangular bulrushes have not as yet proved troublesome in the rice fields.

SPIKE RUSH, *Eleocharis palustris*. (See fig. 16.)—The spike rush is erroneously called "wire grass" and "tule grass." It is abundant in marshes throughout the great interior valley, and tolerates considerable quantities of alkali in the soil if it is amply provided with



Fig. 17.—Cat-tail, *Typha latifolia*.

moisture. It is grass- or reed-like in appearance, with sheaths at the base representing leaves. The plant spreads by means of perennial horizontal rootstocks from which rise numerous soft hollow stems about an eighth of an inch in diameter. At the apex of each stem there is a small spike about one half an inch to one inch long, lasting for a short period only, which represents the flowers. This soon turns brown and disappears. Although it forms a sod, it has little pasture value. It is troublesome chiefly in places where the water is permitted to become stagnant, or in the case of fallow where the drainage is inadequate. We have seen some instances where the rice fields have had to be abandoned because of the presence of this plant in poorly drained areas.

CAT TAIL, *Typha latifolia*. (See fig. 17.)—This well known plant is frequently included among the "tules." It is quite abundant in marshy places throughout the Sacramento and San Joaquin valleys.

It may be recognized by its long slender flat leaves and compact cylindrical flower head. These heads are frequently seen in art stores, where they are artificially colored and used for decorative purposes. To give an idea of its seed production it may be said that there are hundreds of thousands of seed on each head. Each seed is about the size of a pin head and has several cottony appendages admirably adapted for dissemination by the wind for long distances. The cottony masses seen along the roadside in late summer are frequently those of the cat tail. Little is known as to how long these tiny seeds will remain viable. By placing a pinch of the cottony seed

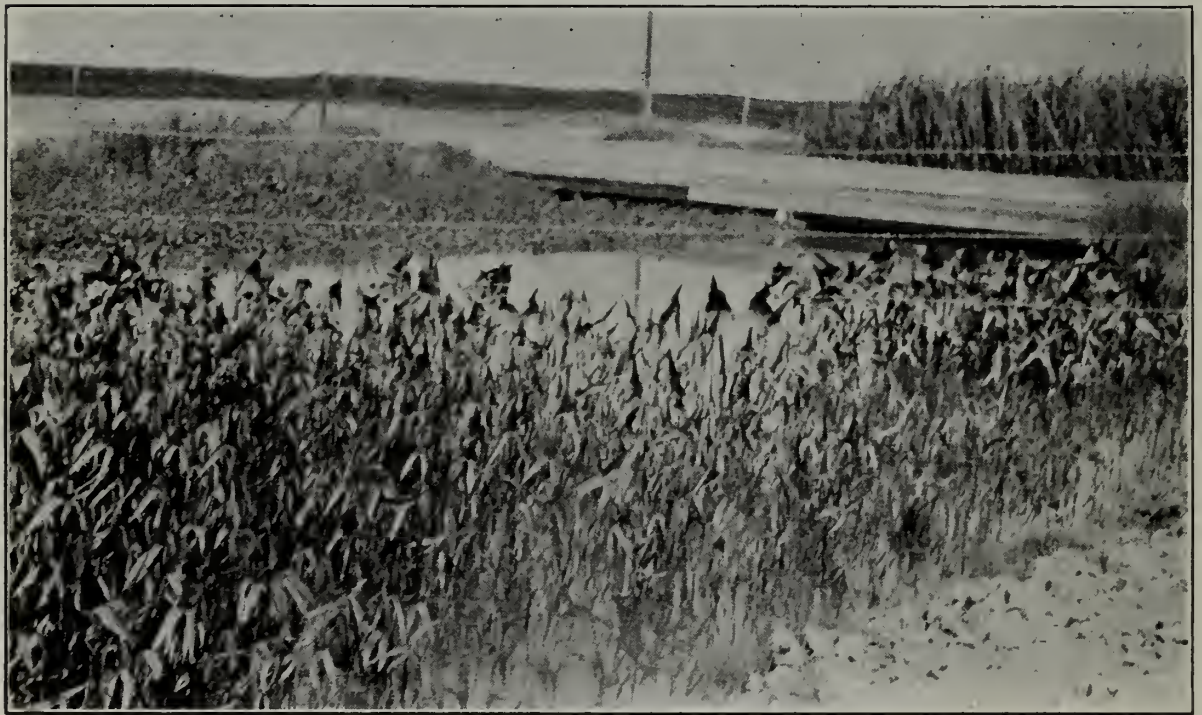


Fig. 18.—Typical growth of Arrow-head, *Sagittaria latifolia*.

mass in a pot in the greenhouse and keeping the soil saturated with water about fifty plants were obtained. Control of the cat tail will depend largely upon facilities for ample drainage. If the water table is near the surface, the plant will continue to be troublesome. Plowing in the fall to expose the rootstocks to the frost, followed by disking in the spring to expose them to drought, will be found helpful. The plant grows very rapidly from seed the first season, the leaves extending above the mature rice and remaining green. They are very troublesome at harvest time because of the excess of moisture which they contain. Plants growing from pieces of the broken up rootstocks of the previous season will produce flower heads in a few months. Every effort should be made to prevent the plants growing in waste places adjacent to rice fields from going to seed, especially if they are located on the windward side of the field, as millions of seeds will be blown across to reinfest the rice land.

ARROWHEAD, *Sagittaria latifolia*. (See fig. 18.)—This plant is known to everyone because of its frequent occurrence in wet places and the characteristic shape of its leaves. These range from a few inches in length to as much as a foot. They are extremely variable, ranging from very narrow and slender to very broad. The long tail-like lobes at the base may be from one quarter to one half as long as the blade. The leaf stalks extend from the base of the plant, being broad and in the nature of a sheath at the base and gradually tapering to the point of connection with the blade. The whorled



Fig. 19.—Pondweeds (*Potamogeton*) floating on water.

clusters of rather large white flowers about an inch across, with numerous yellow anthered stamens in the center, help to distinguish it from other water plants growing in similar situations. The seeds or achenes are beaked and in a dense globose head. Arrowhead is a perennial and forms tuberous growths at the base which are edible. An occasional plant may be seen among the rice, but it has not been particularly troublesome.

WATER PLANTAIN, *Alisma plantago aquatica*.—The water plantain frequents shallow water or muddy places and is more troublesome in the ditches than in the rice fields, so much so in fact that it has to be cut with a scythe during the irrigation period. The blades of the leaves are extremely variable, ranging from narrow to broadly lance shaped and tapering at each end, while the leaf stalks extend to the base of the plant. They may float in the water or remain erect,

if the plant is growing in mud. The small whitish flowers are borne on a large, loose, much branched and whorled panicle, which may extend far beyond the leaves. The seeds or achenes are in a circle on a flat receptacle. They are about one twelfth of an inch long and strongly flattened, with a very short beak on the inner side.

UPRIGHT BUR-HEAD, *Echinodorus cordifolius*.—This plant has been found quite abundantly in the laterals, ditches, and open spaces in the rice fields. It resembles the water plantain and no doubt has been frequently mistaken for it. The leaves are broadly heart-shaped and do not taper at the base as in the water plantain. The seeds or achenes are not in a circle, but form a head with their beaks prominent and bur-like.

LARGE-LEAVED POND WEED, *Potamogeton amplifolius*. (See fig. 19.)—This plant is a perennial, common in fresh water ditches and canals in both of the great valleys. It has stout roots firmly set in the muddy bottoms of water ditches; long stems, either simple or branched; leaves floating on the water, oval to ovate, rounded at the base, and abruptly pointed at the apex; also submerged leaves elliptic, oval, or lanceolate and usually petioled. Its flowering spikes are from one to two inches long. Similar species with smaller and narrower leaves are *P. spirillus* and *P. pectinatus*. The plant is found abundantly in water ditches and canals throughout most of the San Joaquin Valley and is quite common in similar places in the Sacramento Valley, especially in the rice section of Butte County. It is apt to take possession of canals in which the water is from four to five feet deep, where it forms great masses of stems and leaves so that it has to be cut and removed by hand several times during each irrigation season.

RUSHES or REEDS, *Juncus*.—These plants resemble grasses and are called grasses by almost everyone. They prefer localities where there is an abundance of water. The structure of the flower is similar to that of many of our well-known flowers, such as the lily, viz., there are three sepals, three petals, and three or six stamens. The flowers, however, are usually small and never highly colored, being usually green or brownish. They are easily distinguished from those of the grasses and sedges, which consist of scales or bracts enclosing the flower, which has neither sepals nor petals, but stamens and pistils only. The scales are arranged opposite one another on the axis, and not in whorls like the sepals and petals of the rushes. There are many species of rushes in the rice districts. The following have been collected: *Juncus leseuri*, *J. xiphioides*, *J. patens*, *J. phaeocephalus* var. *paniculatus*, *J. effusus*, and *J. bufonius*.

WILLOWS, *Salix*.—The seedlings of willows sometimes cause trouble in rice areas near creeks. They grow with great rapidity, and may attain a height of several feet in a season. The basket willow, *Salix exigua*, seems to be the most troublesome in this respect.

RED STEM, *Ammania coccinea*. (See fig. 20.)—An erect simple or branched annual plant one to three feet high, with four-angled stems and narrow leaves opposite one another, attached directly to the stem by their lobed bases. The small purplish flowers appear as clusters at the axils of the leaves and develop into round capsules about one twelfth of an inch in diameter. These are filled with a powder-



Fig. 20.—Red Stem, *Ammania coccinea*, growing in rice field.

like mass which constitutes the seeds. It is frequently seen in low lands in the Sacramento and San Joaquin Valleys, and since the establishment of rice sections there, it finds ample opportunity for rapid increase and development. The plant is not readily observed at first in the rice fields, as it rarely appears above the rice. Toward the harvest season, however, when the stems turn red it becomes conspicuous. The chief complaint against red stem is that it takes up space and nourishment that is needed for growing rice plants. If the plant is mature, the seeds readily burst from the capsules, and are separated at the time of threshing without difficulty. Frequently the capsules are still immature at harvest time and pass along with the rice, thus causing anxiety in consequence of the excessive moisture which they introduce into the sacks. A characteristic feature

of the plant is the cottony mass produced by the rupture of the epidermis at the base of the stem under the water.

WILLOW HERBS, *Epilobium paniculatum*, *E. californicum*.—The willow herbs are found abundantly on the levees. They are not troublesome in relation to the rice crop. The plant grows from one to four feet high, branching profusely. Numerous small violet-colored flowers are borne on the ends of the slender branchlets. These later develop seed containers, which are about an inch long and more or less angled. Within these are numerous tiny black seeds each with a small tuft of delicate whitish hairs enabling it to be readily disseminated by the wind.

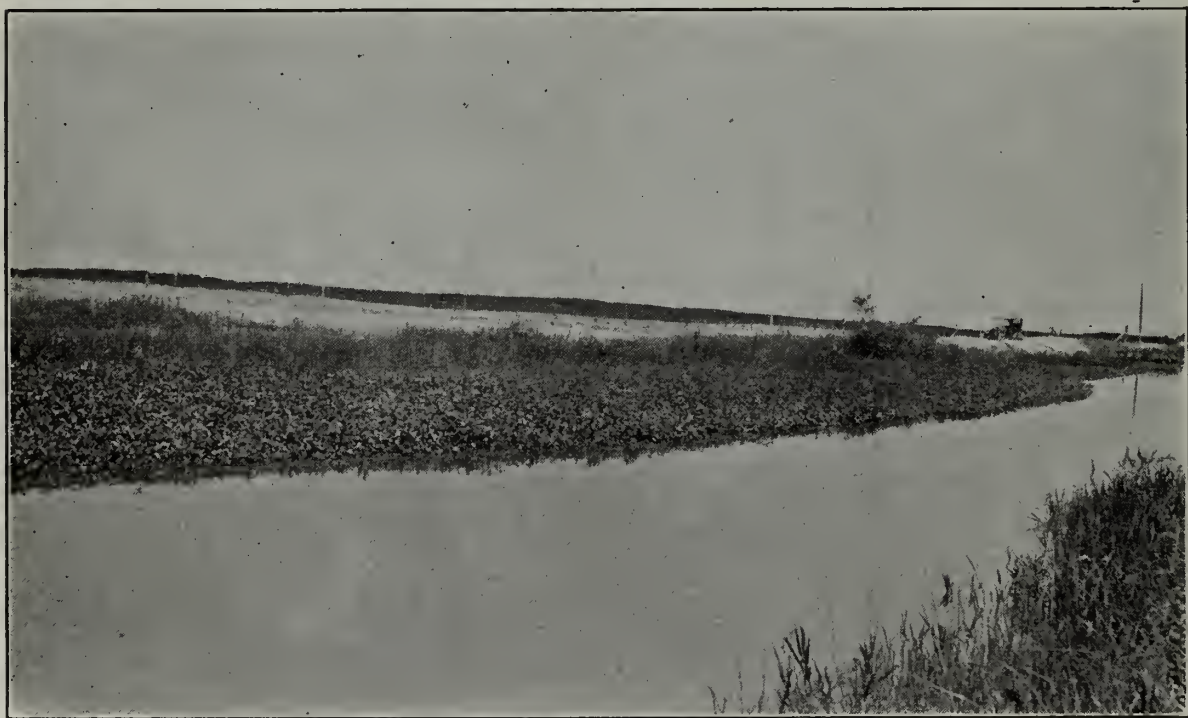


Fig. 21.—California Water-weed, *Jussiaea californica*.

CALIFORNIA WATER WEED, *Jussiaea californica*. (See fig. 21.)—A perennial creeping or floating water plant particularly abundant in the swamps in the San Joaquin Valley. It is not so frequent in the Sacramento Valley, although we found it occasionally at Biggs. The conspicuous yellow flowers are borne singly in the leaf axils.

SMARTWEEDS, *Polygonum*.—The smartweeds frequent shallow ditches and are troublesome in that they impede the flow of water. The species most frequent in the rice sections is the willow-leaved smartweed, so called because of the resemblance of its leaves to those of a willow. It is an annual two to three feet tall, with the stems branching into a spray of small whitish or pale pink blossoms.

WATER HOREHOUND, *Lycopus americanus*.—A perennial mint, only slightly aromatic, with clusters of small white flowers in the axils of the leaves. The stems are four-angled, more or less branched, and from one to three feet high, bearing tooth-margined leaves from one to two inches long. It is found growing on wet soil or in shallow water. It has not as yet seriously interfered with the rice crop.



Fig. 22.—Horseweed, *Erigeron canadensis*.

BEARDED MINT, *Pogogyne douglasii*.—An annual sweet aromatic plant growing from four inches to two feet high, with blue flowers surrounded by hairy bracts forming a dense spike. It is frequent in low lands, overflowed areas, and ditch bottoms around Biggs and elsewhere. Although abundant, it does not seem to be aggressive.

HORSE WEED, *Erigeron canadensis*. (See fig. 22.)—This is a very common annual weed along ditch banks and levees, and in fields and moist places throughout the state. It is of frequent occurrence in the rice region, but not directly in the checks, so that it does not interfere with the production of the rice crop.

PITCHFORKS, BUR MARIGOLDS, or BEGGAR TICKS, *Bidens*.—Several different species of pitchforks occur in the state in the form of wet meadow or swamp plants. The most common variety in the rice sections is *Bidens frondosa*. It is a branching annual two to three



Fig. 23.—Young plant of Spiny Cockle-bur (Clot-Bur), *Xanthium spinosum*.

feet tall, with divided leaves and yellow flowers. The seed is provided with two bristles or awns, resembling the tynes of a pitchfork. It is one of the seeds most likely to attach itself to one's clothing while making observations in the rice fields. As yet it has not proved especially troublesome in relation to the rice crops.

SPINY CLOT BUR or COCKLE BUR, *Xanthium*. (See fig. 23.)—The spiny clot bur thrives in both moist and dry places. It is found on the levees and roadsides, and may be considered more of a nuisance than a rice crop pest. The plant produces strong yellow spines and

oblong cylindrical burs covered with hooked bristles, which readily adhere to any passing object. Ordinary care in preventing the plant from seeding should control it.



Fig. 24.—Slender Aster, *Aster exilis*, in stubble fields.

SLENDER ASTER, *Aster exilis*. (See fig. 24.)—This is a luxuriant annual branching aster common to the rice stubble fields, appearing as tall green patches in the summer and producing sprays of small insignificant pale pink or purple flowers late in the season. The plant grows from one to five feet high and has few and extremely narrow leaves, which are from one to several inches in length. The flowering heads are about one quarter of an inch long, and the soft white pappus is about twice as long as the heads.

LIST OF RICE WEEDS

| Common Name | Botanical Name | Family | Habitat |
|--|---|---|-----------------------------------|
| 1. Water Grass..... | <i>Echinochloa crus-galli</i> and vars..... | Gramineae (Grasses) | The worst pest in rice fields. |
| 2. Joint Grass..... | <i>Paspalum distichum</i> | Gramineae..... | Laterals and fields |
| 3. Sprangle-top..... | <i>Leptochloa fascicularis</i> | Gramineae..... | Roadsides and rice fields |
| 4. Gnawed Canary Grass..... | <i>Phalaris paradoxa</i> | Gramineae..... | Stubble lands and fields |
| 5. Bracted Canary Grass..... | <i>Phalaris brachystachys</i> | Gramineae..... | Stubble lands and fields |
| 6. Small Canary Grass..... | <i>Phalaris minor</i> | Gramineae..... | Stubble lands and fields |
| 7. Rice Cut Grass..... | <i>Leersia oryzoides</i> | Gramineae..... | Sloughs |
| 8. Crab Grass..... | <i>Syntherisma sanguinalis</i> | Gramineae..... | Levees |
| 9. Tufted Love Grass..... | <i>Eragrostis pilosa</i> | Gramineae..... | Fields |
| 10. Beard Grass..... | <i>Polypogon monspeliensis</i> | Gramineae..... | Stubble fields and fallow lands |
| 11. Alkali Beard Grass..... | <i>Polypogon littoralis</i> | Gramineae..... | Stubble fields and fallow lands |
| 12. Red Rice..... | <i>Oryza rufipogon</i> | Gramineae..... | Growing with the rice |
| 13. Slough Grass..... | <i>Beckmannia erucaeformis</i> | Gramineae..... | Sloughs |
| 14. Pigeon Grass..... | <i>Setaria glauca</i> | Gramineae..... | Levees and waste places |
| 15. Rye Grass..... | <i>Lolium multiflorum</i> | Gramineae..... | Wet fallow land |
| 16. Salt Grass..... | <i>Distichlis spicata</i> | Gramineae..... | Moist alkaline situations |
| 17. Green Umbrella Plant..... | <i>Cyperus virens</i> | Cyperaceae (Sedges, Bul-rushes, Tules and Spike Rushes) | Ditches mostly |
| 18. Small-flowered Umbrella Plant..... | <i>Cyperus difformis</i> (?)..... | Cyperaceae..... | Growing with rice |
| 19. Water Umbrella Plant..... | <i>Cyperus erythrorhizos</i> | Cyperaceae..... | Borders of checks and levees |
| 20. Common Bulrush or Tule..... | <i>Scirpus occidentalis</i> | Cyperaceae..... | Waste flooded areas |
| 21. Three-square Bulrush..... | <i>Scirpus robustus</i> | Cyperaceae..... | Neglected areas |
| 22. Olney's Bulrush..... | <i>Scirpus olneyi</i> | Cyperaceae..... | Seepage places by roadsides |
| 23. Spike Rush..... | <i>Eleocharis palustris</i> | Cyperaceae..... | Ditches, fields, and waste areas. |

LIST OF RICE WEEDS—Continued.

| Common Name | Botanical Name | Family | Habitat |
|--------------------------------|---|-----------------------------|---|
| 24. Cat tail..... | <i>Typha latifolia</i> | Typhaceae..... | Ditches, fields, and sloughs |
| 25. Arrowhead..... | <i>Sagittaria latifolia</i> | Alismaceae..... | Low places in checks and in ditches |
| 26. Water Plantain..... | <i>Alisma plantago</i> | Alismaceae..... | Ditches |
| 27. Upright Burhead..... | <i>Echinodorus cordifolius</i> | Alismaceae..... | Ditches |
| 28. Large-leaved Pondweed..... | <i>Potamogeton amplifolius</i> | Naiadaceae (Pondweeds)..... | Floating in ditches |
| 29. Small-leaved Pondweed..... | <i>Potamogeton spirillus and pectinatus</i> | Naiadaceae (Pondweeds)..... | Floating in ditches |
| 30. Wire Reed..... | <i>Juncus leseuri</i> | Juncaceae (Reeds)..... | Marshes |
| 31. Bog Reed..... | <i>Juncus effusus</i> | Juncaceae (Reeds)..... | Marshes |
| 32. Marsh Reed..... | <i>Juncus xiphioides</i> | Juncaceae (Reeds)..... | Marshes |
| 33. Basket Willow..... | <i>Salix exigna</i> | Salicaceae..... | Seedlings invade rice fields near streams |
| 34. Red Stem..... | <i>Ammania coccinea</i> | Lythraceae..... | In rice fields |
| 35. Small Red Stem..... | <i>Ammania humilis</i> | Lythraceae..... | In rice fields |
| 36. Willow Herb..... | <i>Epilobium paniculatum</i> | Onagraceae..... | Levees |
| 37. California Water-weed..... | <i>Jussiaea californica</i> | Onagraceae..... | Laterals |
| 38. Smartweed..... | <i>Polygonum lapathifolium</i> | Polygonaceae..... | Ditches |
| 39. Water Horehound..... | <i>Lycopus americanus</i> | Labiatae..... | Wet soil and shallow water |
| 40. Bearded Mint..... | <i>Pogogyne Douglasii</i> | Labiatae..... | Wet soil and shallow water |
| 41. Horse Weed..... | <i>Erigeron canadensis</i> | Compositae..... | Levees and fields |
| 42. Pitchforks..... | <i>Bidens frondosa</i> | Compositae..... | Borders of ditches and levees |
| 43. Spiny Cocklebur..... | <i>Xanthium spinosum</i> | Compositae..... | Levees and waste places |
| 44. Slender Aster..... | <i>Aster exilis</i> | Compositae..... | Stubble and fields |



Fig. 25.—Harvesting by hand—too weedy to use the binder.

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